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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte RAVI NARASIMHAN

Appeal 2008-1203
Application 10/656,001
Technology Center 2600

Decided: July 21, 2008

Before KENNETH W. HAIRSTON, MAHSHID D. SAADAT, and JOHN A. JEFFERY, *Administrative Patent Judges*.

JEFFERY, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellant appeals under 35 U.S.C. § 134 from the Examiner's rejection of claims 2, 4-8, 10, 13, 15-19, 21, 24, 26-30, 32, 35, 37-41, 43, 46, 48-52, 54, and 57. Claims 9, 11, 20, 22, 31, 33, 42, 44, 53, 55, 58, and 59 have been indicated as containing allowable subject matter (Ans. 13; App. Br. 2). We have jurisdiction under 35 U.S.C. § 6(b). We affirm-in-part.

STATEMENT OF THE CASE

Appellant invented an antenna selection scheme for a multiple-in multiple-out (MIMO) communication system. The optimum number of antennas is selected for communication over correlated fading channels based on second-order statistics.[1] Claims 4 and 7 are illustrative:

4. A method comprising:

selecting a subset of active antennas from a plurality of available antennas in a multi-element antenna system based on higher-order statistics of a propagation medium; and

selecting a constellation for transmission on the active antennas, where said selecting the constellation for transmission on the active antennas comprises selecting different constellations for two or more of the active antennas.

7. A method comprising:

selecting a subset of active antennas from a plurality of available antennas in a multi-element antenna system based on higher-order statistics of a propagation medium, where said selecting comprises selecting an optimum number of antennas to maximize a minimum signal-to-noise ratio (SNR) margin.

The Examiner relies on the following prior art references to show unpatentability:

Malaender	US 2003/0223391 A1	Dec. 4, 2003 (filed Jun. 4, 2002)
Kadous	US 6,801,580 B2	Oct. 5, 2004 (filed Apr. 9, 2002)

[1] *See generally* Abstract; Spec. ¶¶ 0004-05.

Claims 2, 4-8, 10, 13, 15-19, 21, 24, 26-30, 32, 35, 37-41, 43, 46, 48-52, 54, and 57 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Malaender and Kadous (Ans. 3-12).

Rather than repeat the arguments of Appellant or the Examiner, we refer to the Briefs and the Answer for their respective details. In this decision, we have considered only those arguments actually made by Appellant. Arguments which Appellant could have made but did not make in the Briefs have not been considered and are deemed to be waived. *See* 37 C.F.R. § 41.37(c)(1)(vii).

OPINION

In rejecting claims under 35 U.S.C. § 103, it is incumbent upon the Examiner to establish a factual basis to support the legal conclusion of obviousness. *See In re Fine*, 837 F.2d 1071, 1073 (Fed. Cir. 1988). In so doing, the Examiner must make the factual determinations set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966).

Discussing the question of obviousness of a patent that claims a combination of known elements, the Court in *KSR Int'l v. Teleflex, Inc.*, 127 S. Ct. 1727 (2007) explains:

> When a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a person of ordinary skill can implement a predictable variation, §103 likely bars its patentability. For the same reason, if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless

> its actual application is beyond his or her skill. *Sakraida* [*v. AG Pro, Inc.,* 425 U.S. 273 (1976)] and *Anderson's-Black Rock*[*, Inc. v. Pavement Salvage Co*., 396 U.S. 57 (1969)] are illustrative—a court must ask whether the improvement is more than the predictable use of prior art elements according to their established functions.

KSR, 127 S. Ct. at 1740. If the claimed subject matter cannot be fairly characterized as involving the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for the improvement, a holding of obviousness can be based on a showing that "there was an apparent reason to combine the known elements in the fashion claimed." *Id.*, 127 S. Ct., at 1740-41. Such a showing requires:

> "some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness. . . . [H]owever, the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ." *Id*., 127 S. Ct. at 1741 (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).

If the Examiner's burden is met, the burden then shifts to the Appellant to overcome the prima facie case with argument and/or evidence. Obviousness is then determined on the basis of the evidence as a whole and the relative persuasiveness of the arguments. *See In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992).

Claims 2, 4-6, 8, and 10

Regarding representative independent claim 4,[2] Appellant argues that Malaender does not teach or suggest selecting different constellations for two or more of the active antennas as claimed. Appellant adds that Kadous merely processes received symbol streams, but does not teach or suggest varying the number of antennas or the constellations selected for the antennas. According to Appellant, all of the antennas in Kadous use the same constellation (App. Br. 11-12; Reply Br. 3).

The Examiner notes that Kadous discloses such constellation selection since each antenna transmits an associated data stream whereby coded data for each data stream is modulated based on one or more constellation selections (Ans. 13-14).

The issue before us, then, is whether Appellant has shown that the Examiner erred in finding that the collective teachings of Malaender and Kadous teach or suggest all limitations of representative claim 4. For the following reasons, we find that no such error has been shown.

Malaender discloses a multiple-input, multiple output (MIMO) communication system 100 in which a transmitter 110 can adjust a transmission parameter including the number of antennas to employ from an array of antennas 111 (Malaender, Abstract, ¶¶ 0008, 0016, 0019; 0043-44; Fig. 1A). The transmitter demultiplexes an input data stream 112 into different substreams. Each substream is then transmitted from a different transmit antenna (Malaender, ¶¶ 0019, 0024).

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[2] Appellant argues claims 2, 4-6, 8, and 10 together as a group. *See* App. Br. 11-12. Accordingly, we select claim 4 as representative. *See* 37 C.F.R. § 41.37(c)(1)(vii).

Kadous discloses techniques for processing multiple received symbol streams in a MIMO system in which the order that the symbol streams are processed is based on metrics indicating the quality of the detected symbol stream (Kadous, Abstract). The system comprises a transmitter system 110 that transmits a particular data stream over a respective transmit antenna. Each data stream is independently processed (e.g., coded, interleaved, and symbol mapped) at the transmitter (Kadous, col. 4, ll. 25-42; Fig. 1). The multiplexed and coded data for each data stream is modulated (symbol mapped) based on one or more modulation schemes (e.g., BPSK, QPSK, M-PSK, or M-QAM) (Kadous, col. 4, ll. 48-52).

As shown in Figure 5, Kadous' transmitter system comprises a number of transmitters 122 that receive and process a respective transmission symbol stream to generate a modulated signal for transmission from the associated antenna 124 (Kadous, col. 18, ll. 15-17; Fig. 5). Significantly, each data stream's symbol mapping element 516 forms a non-binary symbol and maps this symbol to a specific point in a signal constellation corresponding to the selected modulation scheme (e.g., QPSK, M-PSK, M-QAM, etc.) (Kadous, col. 17, ll. 45-51).

Based on this functionality, we find no error in the Examiner's conclusion that the collective teachings of Malaender and Kadous teach or suggest all limitations of representative claim 4. We find that Kadous amply suggests selecting different constellations for two or more of the active antennas as claimed, and that such a teaching would have been readily combinable with Malaender.

As an initial matter, the modulation and coding schemes of Kadous noted above fully meet a "constellation" in light of Appellant's description

of the term in the Specification. *See, e.g.*, Spec. ¶ 0037 (noting that "constellations may be selected from, e.g., binary phase shift keying (BPSK), quadrature phase shift keying (QPSK), 8-point phase shift keying (8-PSK), 16-point quadrature amplitude modulation (16-QAM) and 64-QAM."); *see also* Spec. ¶ 0052.

Furthermore, each transmitted data stream in Kadous is independently processed (i.e., separate coding and modulation on a *per-antenna basis*) to provide a corresponding modulation symbol stream. Significantly, these coding and modulation schemes for each data stream can be the same *or different* (Kadous, col. 17, ll. 3-8; emphasis added).

As such, we find ample suggestion to provide different constellations for transmission on two or more of the antennas that transmit the respective data streams. Such a selection would have been well within the level of ordinarily skilled artisans depending on the data stream transmitted by each antenna.

We see no reason why such a teaching could not be applied to Malaender's system which transmits data streams via selected antennas from an array. Since each substream in Malaender can be mapped to a particular transmit antenna in the array (Malaender, ¶ 0024), and the number of antennas employed is selected as noted above, skilled artisans would have therefore selected different constellations for transmission on particular data streams associated with respective selected antennas in view of Kadous' teachings. That the transmitted constellation size can also be adjusted for maximum throughput in Malaender (Malaender, ¶ 0025) only reinforces our conclusion that skilled artisans could vary the constellations with respect to the transmitted data streams in addition to the number of antennas.

Appellant's arguments pertaining to Kadous are unavailing. While Kadous does process received symbol streams as Appellant indicates (App. Br. 12; Reply Br. 3), this argument is not germane to the functionality of Kadous' transmission system of Figure 5—a system that transmits data streams via an array of antennas and that varies the constellations on a per-antenna basis as noted above.

We further find Appellant's argument pertaining to the alleged use of the same 16-QAM constellation in Kadous (App. Br. 12; Reply Br. 3) unpersuasive. Although the performance shown in Figure 4 is for an MIMO system with two transmit antennas and four receive antennas that uses 16-QAM coding, the reference is by no means limited to this example. As we noted above, Kadous strongly suggests varying the constellations for each data stream (Kadous, col. 17, ll. 3-8).

We therefore find no error in the Examiner's combining Kadous with Malaender to arrive at the claimed invention. We add that ordinarily skilled artisans would likewise have ample reason to select a subset of antennas used in Kadous' transmission system of Figure 5 in view of the teachings of Malaender to, among other things, increase data throughput (Malaender, Abstract, ¶ 0016). From either perspective, the limitations of representative claim 4 are amply taught and suggested by the collective teachings of the cited references.

For the foregoing reasons, Appellant has not persuaded us of error in the Examiner's rejection of representative claim 4. Therefore, we will sustain the Examiner's rejection of that claim, and claims 2, 5, 6, 8, and 10 which fall with claim 4.

Independent Claims 15, 26, 37, and 48 and their Dependent Claims

Although Appellant nominally argues the rejection of independent claims 15, 26, 37, and 48 and their dependent claims separately (App. Br. 14-18; Reply Br. 5-8), Appellant essentially reiterates the same arguments we considered above with respect to claim 4. Therefore, we sustain the rejection of independent claims 15, 26, 37, and 48 and dependent claims 13, 16, 17, 19, 21, 24, 27, 28, 30, 32, 35, 38, 39, 41, 43, 46, 49, 50, 52, and 54 for the same reasons discussed above with respect to claim 4.

Claim 7

Regarding claim 7, Appellant argues that the prior art does not teach or suggest selecting an optimum number of antennas to maximize a minimum signal-to-noise ratio (SNR) margin as claimed (App. Br. 13-14; Reply Br. 4-5). The Examiner contends that Kadous teaches the limitation since symbol streams are selected with the highest margin and that each symbol stream is based on SNR (Ans. 14).

The issue before us, then, is whether Appellant has shown that the Examiner erred in finding that the prior art teaches or suggests selecting an optimum number of antennas to maximize a minimum SNR margin as claimed. For the following reasons, we find that Appellant has shown such error.

We note at the outset that claim 7 does not merely call for selecting an optimum number of antennas based on an SNR margin, but rather such selection is to *maximize a minimum* SNR ratio margin. To interpret this

limitation, we first turn to Appellant's Specification for guidance.[3] The Specification notes that the minimum SNR margin is given by Equation (2), and is based, in part, on the minimum post-processing SNR among all data substreams (Spec. ¶¶ 0021-0024). It is this minimum SNR margin that is maximized via antenna selection—a selection yielded via Equations (5) and (6) (Spec. ¶¶ 0030-35).

With this guidance, we turn to the prior art. Although Kadous selects a detected symbol with the highest SNR margin (i.e., the difference between the equivalent SNR and the required SNR) for recovery as the Examiner indicates (Kadous, col. 16, ll. 15-33), we agree with Appellant that this teaching does not suggest selecting an *optimum number of antennas* based on such a margin. And even if it did, we still fail to see how such a selection would *maximize a minimum* SNR margin as claimed in light of the Specification.

Malaender fares no better in this regard. While Malaender does teach selecting an optimum number of antennas as noted previously, this selection is based on factors that, at best, merely account for the SNR (*see, e.g.,* Malaender, ¶¶ 0043-51). This selection, however, is not based on an SNR margin, let alone *maximizing a minimum* SNR margin as claimed in light of the Specification.

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[3] *See Phillips v. AWH Corp.,* 415 F.3d 1303, 1321 (Fed. Cir. 2005) (en banc) ("[T]he specification is the single best guide to the meaning of a disputed term, and…acts as a dictionary when it expressly defines terms in the claims or when it defines them by implication.") (internal quotation marks and citations omitted).

For the foregoing reasons, Appellant has persuaded us of error in the Examiner's rejection of independent claim 7. Therefore, we will not sustain the Examiner's rejection of that claim.

Claims 18, 29, 40, 51, and 57

Since claims 18, 29, 40, 51, and 57 recite limitations commensurate with claim 7, we will not sustain the Examiner's rejection of these claims for the same reasons we indicated above with respect to claim 7.

DECISION

We have sustained the Examiner's rejection with respect to claims 2, 4-6, 8, 10, 13, 15-17, 19, 21, 24, 26-28, 30, 32, 35, 37-39, 41, 43, 46, 48-50, 52, and 54. We have not, however, sustained the Examiner's rejection with respect to claims 7, 18, 29, 40, 51, and 57. Therefore, the Examiner's decision rejecting claims 2, 4-8, 10, 13, 15-19, 21, 24, 26-30, 32, 35, 37-41, 43, 46, 48-52, 54, and 57 is affirmed-in-part.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED-IN-PART

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